MSc thesis project 2022 on the Division of Marine Technology,
Department of Mechanics and Maritime Sciences, Chalmers University of Technology

Development of new idealized structural units for ultimate strength analyses of plated structures

(Scientific fields: Solid mechanics, Naval architecture, Civil engineering)

Background and motivation

Ships, bridges, box-girder cranes are examples of plated structures. The most fundamental characteristic of such structures is ultimate strength defining the maximum limit up to which a structure can hold. Total collapse of a structure due to exceedance of its ultimate limit can result in catastrophic consequences such as injuries and loss of lives, environmental pollution, and loss of material assets. Therefore, reliable estimates of ultimate strength are of paramount importance for safe and robust structural design. There are clear procedures in the rules on how these analyses to be carried out, but during an ongoing research project on the division of Marine Technology, areas for further improvement were identified.

Objectives and goals of the project

During the project students are provided an opportunity to contribute to the engineering community through development, implementation, and validation of new idealized structural units for ultimate strength analyses by the Smith method. The goal of the project is to determine appropriate models to describe response in compression of non-regular structural elements: (i) panels with curvature, (ii) panels with openings and (iii) damaged panels with large plastic deformations. The proposed models to be validated by means of finite element simulations and implemented into the URSA software developed at the division of Marine Technology.

Methods and tools

The published theories and procedures for buckling and ultimate strength of non-regular stiffened panels will form a basis for a Matlab/Python code that will be developed during the master thesis project. The thesis should be written in Word using a template provided by the department.

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The MSc thesis project should incorporate (at least) the following tasks:

- Literature survey
- Coding in Matlab/Python of theory for buckling and ultimate strength analysis
- Ultimate bending strength analyses of box girders in URSA with new implementations
- Finite element simulations for validation of the proposed models
- Write a thesis report and present on a public seminar

Contact person (examiner and supervisor at Chalmers):
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Co-supervisor: Artjoms Kuznecovs (PhD student on the Division of Marine Technology)